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Status of the Energy Industry and the Mission of Energy Conservation

926B0029A Beijing KEJI RIBAO in Chinese 14 Oct 91 p 3

[Article by Lu Zhongwu [7120 6945 2976]]

[Text] China is a country that is rather rich in energy resources; its coal reserves are third largest in the world; petroleum reserves are eighth; natural gas is 16th; water resources are very rich, first in the world; the nuclear fuels, uranium and thorium, are also plentiful. The pace of development of China's energy resources since liberation has been quite rapid; in 1990 energy produced from coal, petroleum, natural gas, and hydropower, in terms of standard coal, was over 1 billion tons. But, because of the large population, China's per capita annual energy resource consumption was .91 tons standard coal, less than half of the world average 2.3 tons, and compared with industrially developed countries, it is even lower. In 1990, for every 10,000 yuan of gross national production value in China, consumption was 9.3 tons, much higher than that of industrially developed countries. The reasons are many: controls are poor, the consumption ratio for heavy industry is high, facilities are old, technology is quite backward, and coal is the mainstay of China's energy resources, whereas in western industrially developed countries it is oil, as it is typically throughout the world. Among the world's energy resources today petroleum is first at 44 percent, and coal is only 33 percent. In China, coal makes up 71 percent. Coal compares poorly with oil in extraction, transportation, and utilization, and its combustion efficiency is quite inferior, which affects the energy consumed per unit of product value.

By century's end China wants to realize a quadrupling of gross value of industrial and agricultural output. By the year 2000 the national gross output value should be 4 times what it was in 1980. In the process of realizing this strategic target, energy resources will be a key ingredient. At the present technology level of utilization of energy resources, by century's end an output of only 1.36 billion tons of standard coal will be possible. Notwithstanding the difficulty of achieving that volume, even if attained, it will be 400 million tons short of needs in the year 2000. That is to say, to guarantee that a quadrupling is accomplished, the average annual rate of energy savings in the last 10 years will have to be 2.6 percent. In view of the actual situation of the last 2 years, it will be very difficult to reach that rate of energy savings. For this reason, whereas development and conservation are both important, China's energy policies will give preference to conservation in the near term. These general and specific policies are absolutely correct. They proceed from China's actual situation. They are practical and realistic. Only by working in accordance with these policies can China's energy resources problem be resolved.

As to the development of energy resources, preference must be given to development of coal and hydropower. China's plans are to build 4 to 5 new major coal mines, and continue to construct the presently existing coal bases. The hydropower resources of the middle reaches of the Huang He and the Hongshui He must be developed, and several large-scale hydropower stations must be built. Geographically, the electric power generating regions are mainly in the west, and the areas that need electricity are largely in the east. Therefore, to deliver western electricity to the east, major power networks must reach to the east, in one coastal belt and one central belt.

China's unique agricultural small-scale hydropower stations are distinguished throughout the world; agricultural villages supply one-third of their electric power needs themselves, and the development of small-scale hydropower for agricultural villages must be continued.

Next, there must be active prospecting and development of petroleum and natural gas. According to expert estimates, China's petroleum reserves are rich and prospects are excellent. In recent years, along the coastal belt and in the Xinjiang area many oil and gas bearing basins have been discovered, and it is believed that China's petroleum exploitation industry will develop rapidly.

And further, in areas deficient in energy resources, nuclear power plants should be built. Two nuclear power plants are now being built in China. Liaoning is another area deficient in energy resources, and a nuclear power plant is badly needed there.

Finally, in the realm of new energy resources, research must be done to develop methane and fuel forests. New energy resources include solar energy and geothermal energy. New energy resources developed in this century seem mainly to be for heating and cooking. A number of technical questions need to be resolved to use them for big industries. Perhaps in the next century they will become the main energy resource for industry. Fuel forests and methane are important energy resources for agricultural villages, and must be greatly developed in future.

In the area of energy conservation, by the year 2000, energy consumption per 10,000 yuan output value must be well below the 1990 level. The present consumption rate of 9.3 tons standard coal per 10,000 gross national output value must be reduced to 7 tons standard coal by year 2000.

How can this be done? This involves questions of adjusting structures and ratios, adjusting backward enterprises, strengthening administration, and technology reform. In recent years, initial successes have been made following the adoption of the above mentioned measures, and energy consumption per 10,000 yuan has been reduced, but although progress has been made it mainly involved adjusting ratios and structures. In the area of technology, consumption quotas, and S&T administration, the actual effects have not been great. More effort must be put into these actions hereafter.

Energy conservation is a very broad issue. Not only does it mean giving attention to conservation of energy resources, but also to conservation of non-energy resources, such as steel, iron, lime, concrete, tiles, leather, cotton, equipment and facilities.

There are those who may ask why does energy conservation mean conservation of non-energy resource materials. The reason is simple. Because the manufacture of all raw materials, products, and various types of consumer products require energy resource materials. If non-energy resource materials are wasted, energy resources are wasted.

There is a predisposition at present to focus on conserving energy and overlook conservation of non-energy resources; to consider coal, oil, gas, and electricity, but disregard or inappropriately handle the products, paraphernalia, raw materials, and supplementary materials derived through energy resources.

Consumption of raw materials is very high in China, the ratio of wasted products is high, and the ratio of finished products is low, so it is imperative that this issue be emphasized. Energy conservation demands a two-fisted approach, energy resources in one hand and non-energy resources in the other. To do this, the following are suggested:

1. In industrial production there must be "total conservation", conservation of energy and non-energy resources, and furthermore, it must be recognized that conservation of non-energy resources means conservation of energy resources.

2. In every factory and every process the conservation of raw materials, associated materials, and other consumer items must be strictly accounted for just as energy resources are.

3. Along with the means of rewarding strong conservation, there must be a means of rewards for conservation of non-energy resource materials as well.

4. All enterprises that have high consumption of energy and non-energy resources should temporarily halt production and make adjustments, and after conditions are good, then production may be resumed.

Improving Energy Conservation Work in the Power Industry

926B0012A Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese 5 Sep 91 pp 2-4

[Article by Yue Luqun [1471 7773 5026] of the Conservation Office, Ministry of Energy]

[Text]

I. The Strategic Role of Conservation in the National Economy

Energy is an important material basis of the national economy, it is also a fundamental condition for human survival. The solution of the energy problem takes two things: development and conservation. Since the energy crisis in 1973, every country in the world has placed energy on the front. In China the Party and the government have given energy great attention. In 1980, the State Council announced that energy work should stress both development and conservation and in the near term conservation should have the priority. In the foreword of his translation of the book *Rational Utilization of Electrical Energy in Mechanical Manufacturing* Comrade Jiang Zemin [3068 3419 3046] pointed out that "China's modernization faces a great challenge in energy. Facts taught us that to succeed in the Four Modernizations, we must first solve the energy problem. Although the development of energy resources is important, it is essential to conserve energy." Why do we emphasize conservation? What is the role of conservation in China's development of the national economy and society? What effects will conservation have on current and future economic and social development in China? It is very important to have a correct understanding of these issues.

1. Conservation Is Important to the Sustained, Stable, and Coordinated Development of the Chinese Economy

Conservation has a direct effect on the speed of China's economic development. Since the establishment of the People's Republic, the development of energy production in China has been very fast. In 1990, the total production of primary energy in China has reached 1 billion tons of standard coal, or the third in the world. However, this level still cannot satisfy the needs of the national economy and there is severe shortage. Electrical energy shortage in China has lasted more than 20 years. The production of 1 billion tons of raw coal has put great strain on the transportation system. The net gain in petroleum production every year fell far behind the needs. Judging from the Eighth 5-Year Plan and the 10-year plan of China's economic development, energy supply and demand in the next 10 years will still be very problematic. In order to achieve the grand target set by the 12th Party Congress to quadruple the gross value of production in industry and agriculture by the end of this century, it is estimated that 1.8 billion tons of standard coal will be required in primary energy (based on the current consumption). The actually achievable production is about 1.4 billion tons, that is, 400 million tons of standard coal must come from more efficient use of energy and conservation. Since 1980, various departments in different regions in China, including energy departments, have paid attention to conservation and taken a number of effective measures. Conservation has been very successful. Statistics showed that during the Seventh 5-Year Plan conservation efforts in China have saved more than 80 million tons of standard coal, the energy consumption per 10,000 yuan of production value has decreased from 10.5 tons of standard coal in

1985 to 9.6 tons in 1990, the average rate of energy conservation was 1.8 percent. In the last one or two years, the energy situation in China has changed. The shortage of coal was not as severe and the supply of electric power in some regions has improved. However, this is a temporary phenomenon. In the long term the supply and demand problem in energy will not change fundamentally. We must stress conservation whether the shortage is severe or temporarily alleviated.

2. Conservation and Consumption Reduction Are Important Measures To Raise the Efficiency of China's Economy

On average energy accounts for 9 percent of the product cost in China. Energy consumption has a major impact on the cost of many products. In a thermal electric power plant where the fuel cost accounts for 70 to 80 percent of the product cost, energy consumption is the main factor affecting the product cost. The State Council has declared 1991 the year of "quality, variety, and efficiency" and proposed an overall approach to improve the economic efficiency by investing less and producing more. This is the fundamental solution for overcoming the current difficulty and achieving the strategic goal of the future. In order to improve the economic efficiency, we must increase production and conserve energy. If we can lower consumption by conservation, we can improve economic efficiency substantially.

3. Because China Has a Low Per Capita Energy Allocation and a Low Level of Consumption, Conservation and Cutting Waste Are Urgent Tasks

Although China ranks the third in the world for energy production, but the per capita mineral resources (coal, oil, and natural gas) is only one-seventh of that in the Soviet Union and one-fourth of that in the United States. China is a country of large population and scarce energy resources, and the energy utilization rate in China is only three-fourths of that in industrially developed countries. We must pay great attention to this situation. To ensure a sustained and steady economic development for future generations, we must establish the concept that the "total energy reserve in China is great but the available per capita energy is low and conservation is essential." Mineral resources are limited and cannot be regenerated, China must therefore take the approach of conserving resources and gradually establish a conservation type of economic structure. Resources must be used rationally and never wasted.

4. Conservation and Improving Energy Utilization Are Intimately Related to Environmental Protection, Ecological Balance, and Raising the Standard of Living

Global environmental protection, particularly the greenhouse effect and global warming, has received great attention recently. The biosphere is blanketed by an atmosphere that is almost 800 km thick. Most important to the survival of humans and animals is the 8 to 18 km of convection layer above the earth surface. The atmosphere consists mainly of nitrogen and oxygen, with small fractions of helium, neon, argon, ozone, and carbon dioxide. These gases, although small in amount, are also important to the activity of humans and animals on earth as they help to maintain a constant temperature on earth. According to scientific studies, the average temperature on earth in the last 10,000 years has not changed by more than 2°C, but in the past 100 years alone, the earth's temperature has increased by 0.6°C. The concentration of CO_2 in the atmosphere in 1988 was 25 percent higher than that before the industrial revolution. At this rate of growth, the CO_2 concentration in 2050 will be twice that before the industrial revolution. By that time the earth's temperature will be 1.5 to 4.5°C higher. Weather changes will bring many adverse effects on human society and economic development. Rises in temperature will cause the icebergs to melt and the sea level to rise. Some islands and coastal areas will become submerged, drought and flood will increase, and water resource problems will become more acute. Scientists generally believe that global warming may favor some regions but globally, the minuses definitely outweigh the pluses. The greenhouse effect has attracted the attention of the world. Development and utilization of energy resources, especially mineral resources, invariably lead to environmental pollution. This type of pollution does not follow any national or regional boundary, it is global. Fifty percent of the CO_2 released into the atmosphere come from the energy industry, followed by transportation and building industries. To limit the release of CO_2, the energy industry is the first consideration. The fundamental solutions to environmental protection and ecological balance are therefore conservation and continuous improvement of energy utilization.

II. The Electric Power Industry Must Work Hard on Conservation

The electric power industry transforms primary energy into secondary energy. The electric power industry itself also consumes a great deal of energy and has large potential for conservation. Statistics showed that in 1990 China used 291 million tons of coal for electric power generation and heating, which was 25 percent of the total raw coal production in China in that year. In the future, to improve the energy utilization rate, the growth of electric power generation will be faster than the growth in coal production, and the difference will become greater yet. Data showed that the line loss in the electric power industry was about 8.06 percent in 1990. With the additional 8 percent loss in internal and city and country grids, the total line loss was about 16 percent or 92 billion kWh per year. There is great potential for reducing coal consumption and line loss in the electric power industry in China.

1. Coal Consumption Should Be Reduced by a Large Amount

In the last 40 years, the coal consumption in China has decreased substantially, but there is a long way to go when compared with industrially advanced countries. The coal consumption in Japan and the Soviet Union are

respectively 280 and 320 g/kWh. In China the figure for 1990 was 427 g/kWh, greater than the Soviet figure by a whopping 107 g/kWh. Using 1990 thermal electric power generation data, this amounted to an extra coal consumption of 70 million tons. By the end of this century, the thermal electric power generation in China will reach 1,100 billion kWh. If coal consumption remains the same, each year there will be an extra consumption of 140 million tons of raw coal, a huge amount indeed.

According to the requirement and plan, the electric power industry needs to reduce coal consumption in the next 10 years by about 60 g/kWh, from 427 g/kWh to 365 g/kWh. The main measures include:

(1) New generators should be of the high performance, large capacity variety. New condensation type generators should not exceed a coal consumption of 330 g/kWh. Heating generators should not exceed 270-280 g/kWh. Equipment manufacturing departments and electric power plant design departments should start their work early in order to ensure a reduction of coal consumption.

(2) Medium and low voltage units should be gradually phased out and replaced by larger units. Some of these may be converted into heating units. In addition, measures must be taken to make sure that no more medium and small generators are built in the large power grids. Replaced generators must be stopped and not merely "retired" into third enterprises.

(3) The current 125,000 kW and 200,000 kW generators, and the group of old 300,000 kW units must be improved. The 200,000 kW units in particular were designed to consume 360 g/kWh, 10 percent higher than similar foreign units, but the actual consumption has been 394 g/kWh, and in some cases as high as 420 g/kWh, or 20 percent higher than foreign units. Some units have never achieved full power operation and their equivalent utilization coefficient was 10 percent lower than similar foreign units. Because the 200,000 kW units are mainstay generators, their high coal consumption has not helped energy conservation in the grids. Major revisions must be made to improve the efficiency, including the flow portion of the turbine and the thermal system.

(4) Work on the economic management of the grids, an area with great potential. The goal for the economic management of the grids is to increase the usage of the larger generators and to use the medium and low voltage generators as little as possible or not at all. Today the proportion of low and medium voltage units is fairly high; as a result, the national average coal consumption remained high and even went up for a while. The experience of the Eastern China Electrical Power Administration should be promoted. The economic benefits should be realized by management to "replace the small with the large." Fully utilize the larger, more efficient generators and stop using the less efficient small units, or let the small units assume some of the peak loads. The goal is to lower the overall coal consumption of the thermal electric power system.

(5) Strengthen the conservation management of thermal electric power plants, adhere to the ministry-issued "Energy Conservation Regulations for Thermal Electric Power Plants," and put the conservation responsibility system on a solid basis. The conservation management should emphasize the energy consumption quota. Based on the three-tier conservation management network in electric power plants, conduct target analysis, actively promote competition, establish a sound energy consumption quota evaluation system, and periodically publish conservation targets. Conduct a thermal energy utilization census to find and eliminate leaks. Develop economic analysis to study the various key steps in conservation, put conservation practices on a solid basis, exploit conservation potentials, and further lower coal consumption in electric power plants.

2. Drastically Reduce Line Loss

In 1990 China suffered a line loss of 8.06 percent. Based on the Eighth 5-Year Plan, line loss should be reduced to 7.8 percent by 1995. More reductions are to be made in the 10-year plan. The following efforts should be made in the drive to cut line loss.

(1) Increase the proportion of investment in power transmission and transforming in the electric power developments. In the Seventh 5-Year Plan, China had a large increase in power generation but the corresponding power grid development did not catch up. The investment in power transmission and transforming dropped from the normal 20 percent to 16 percent near the end of the Seventh 5-Year Plan. This not only affected the normal transmission of power but also drove up the line loss. Today, many of China's newly built power plants are far away from the load centers. In order to ensure safe and economic transmission and distribution of electric power, the grid development must be strengthened and the investment in transmission and transforming be increased.

(2) Step up grid improvement. In the past 10 years, we have continuously reduced the line loss by different improvement measures such as raising the voltage. In the last few years, however, price index changes have made the original remodeling and compensation funds inadequate. This makes it necessary to raise the charge for equipment depreciation and compensation in order to raise the money to improve the power grids.

(3) Greatly increase the reactive compensation equipment. With a national average reactive compensation rate of 0.44, most of China's power grids today do not have enough reactive compensation. This has prevented economic operation of the grids and has driven up line loss. In order to raise the reactive compensation rate to a reasonable 0.6, China needs another 20 million kW of reactive compensation equipment.

(4) Strengthen line loss management. Rigorously implement the ministry-issued "Energy Loss Management Regulations for Power Grids," adhere to effective management, continue to promote tiered line loss management, conduct analyses according to voltage and line, perform theoretical calculations, and small target evaluations. Improve the management and guidance of the effort to lower the loss of direct-distribution to large enterprises and city and country users.

Distinctive Nature of Ningxia Energy Base Outlined

926B0022C Yinchuan NINGXIA RIBAO in Chinese 10 Oct 91 p 3

[Excerpt] How to make full use of Ningxia's advantages in coal resources; to open the many ways, administrative layers, and new courses to build an energy resource base with Ningxia's special characteristics; those are the big questions facing the economic development of Ningxia. What follows is an examination of those questions.

In Ningxia, the many means, administrative layers, and meandering courses are already at hand. First, the reserves of coal resources in the region are large, of many varieties, and of fine quality. Of the 10 major types of coal in all the country, only binding coal is lacking. In overall advantages it ranks third in the country. Coking coal is in top place in the northwest, as Ningxia has the only coking coal base in the northwest area. Many types of carbon products can be made from Taixi [1132 6007] coal for good economic profit and foreign exchange. The geological, hydrological, and transportation conditions for long-flame coal from the Lingwu Mining District, and Yanshan in Guyuan County, and for coking coal from Tongxin and Weizhou are all good, suitable for development, and have promising profitability. Second, there is sufficient supply of water resources and electric power, and this double bounty provides a good foundation for scientific research in coal conversion in the region, such as in the research and testing of consolidated processing of Taixi coal and coking coal which has been successful and has established a basis for coal conversion in the region.

Many objective elements influence Ningxia's economic development. It is evident that if materials are converted on location, and a trans-regional industrial linkage is forged with coal and electricity as its base, it would greatly raise the utility and economic advantage of coal. Full use must be made of the varieties of coal, their high-rank, and their versatility to open the way to a multi-faceted, high-tech, coal-chemistry industry of high output value. To aim at domestic and foreign markets with production of products that are marketable will require increased accumulation of the Autonomous Region's finances. Then, a combined enterprise should be organized from coal, electric power, chemical, carbon, light industry and textiles, building materials, and railway enterprises to build the largest coal-conversion combined enterprise base in the northwest region, which will become the pillar of a "Huang He economy", and help Ningxia make a major contribution to socialist construction in China. This way, it can change the railroad transportation situation and the effect of the neighboring rich coal producing provinces and regions that inhibit coal production in Ningxia, and put an end to the many years of passively allowing transportation to determine Ningxia's coal production, and relieve the pressure on rail-shipped coal. In 1990, 15.12 million tons were carried on the region's railroads of which coal accounted for 10.7362 million tons, or 71 percent. If coal were refined into coke, a shipment of 1 ton of coke would be equivalent to 1.8 tons of coal, which is a considerable difference. That would change the backward practice of simply selling raw coal, and increase the utility value and economic profits from coal. If available means were fully utilized for conversion of various coal products the economic value would increase from several tens to several hundred times, and it would create many jobs.

It can be seen that development in the near term would bolster the development of the Lingwu Mining District, help complete the construction of the Daba power plant and help it reach the originally planned annual 2.4 million kW target, and coal could be converted to a secondary energy resource on location in the Lingwu Mining District. The pivotal Daliushu water conservancy project must be finished as soon as possible to further coordinate the development of Ningxia's hydropower and thermopower. [passage omitted]

Shanghai Now Capable of Manufacturing World-Class Power Equipment

926B0022B Shanghai WEN HUI BAO in Chinese 19 Oct 91 p 1

[Article by reporter Ying Yanan [2019 1693 1344]]

[Excerpt] Through more than 5 years of construction and reform Shanghai has the capability for batch production of world advanced-level electric power generating facilities. Its 300,000 kW units of imported advanced technology can now replace imports; 300,000 kW nuclear power units can also be manufactured; and annual production capability of thermoelectric facilities has increased from 1.4 million in 1985 to 2.4 million kW, and increase of 78 percent. This indicates that China's ability to manufacture electric power facilities and construct power plants is abreast of the world's advanced ranks.

In the Seventh 5-Year Plan China approved the Shanghai electric power generation facilities production base project, invested over 200 million yuan, undertook large-scale refurbishing of the Shanghai Electric Equipment Factory, Shanghai Gas Turbine Factory, Shanghai Boiler Factory, and the Shanghai Power Plant Facilities Factory, built 80,000 square meters of factory buildings, and obtained 600 items of domestic and foreign advanced equipment so that the manufacturing technology and level of facilities would be world-class. From

start to finish, 6,000 kW, 12,000 kW, 25,000 kW, 50,000 kW, 125,000 kW, and 300,000 kW units were manufactured there, and it became China's first world-class electric power generating equipment production base. [passage omitted]

According to statistics, in the Seventh 5-Year Plan, Shanghai's total output was 10 million kW of electric power units, of which, 86.3 percent were large-scale units of 125,000 kW and 300,000 kW. Authorities say that in the Eighth 5-Year Plan, the municipality will manufacture 600,000 kW super-critical, sub-critical, and nuclear units, which will lift China's power generating facilities manufacturing technology to a new stage.

Inner Mongolia Reports Massive Energy Construction Progress

926B0022A Hohhot NEIMENGGU RIBAO in Chinese 14 Aug 91 p 1

[Article by reporter Li Shuxiu [2621 3219 4423]]

[Excerpt] [passage omitted] Geological prospecting has confirmed that Inner Mongolia has 228 coal districts spreading black gold from east to west. Not only are the coal reserves large, but they are of high quality and comprehensive in varieties of coal, all of good quality. There are nearly 200 billion tons of proven coal reserves in the whole region, and the long-range estimates anticipate over 1 trillion tons, second in the entire country. Of the five famous major open pit coal mines in China, four—Junggar, Huolinhe, Yuanbaoshan, and Yiminhe—are in the region. Shengli coal field, among the three largest in the world, is China's largest coal dressing base and has proven reserves of 72.5 billion tons, a rare site in the country. The high rank of Taixi coal from Gulaben, Alxa Meng is renowned in the world. Its reserves are 410 million tons, and that is expected to grow to more than 1 billion tons.

For many years the fully outfitted coal mines at Wuda, Haibowan, Pingzhuan, Dayan, and Jalai Nur, have made great contributions to national construction. In recent years following the development and construction of Dongsheng, Junggar, Huolinhe, Yuanbaoshan, and Yiminhe coal fields, the coal output capacity of the region increased markedly, and many mines became special-class or national 1st-class mines. Through ever deepening reforms, the fully equipped coal mines went into production, let general contracts, and made notable profits. In 1990, the whole region produced 46.42 million metric tons; the fully operational mines in the west, in the first half of this year, again attained "over two halves".

The national economic strategy of moving westward provided a golden opportunity for the development of coal resources in the region. Now, the Ordos coal base is booming: Shengli coal field is now in a large-scale construction stage; the first phase of construction of the world-shaking Junggar coal field has fully unfolded, and this year over 1 billion yuan will be invested in it. The jointly managed project at Yiminhe coal mine to achieve an annual output of 5 million tons of coal and 1 million kW of electric power is under accelerated construction. In the next 10 years, from Manzhouli in the east to the western coal city of Wuhai, a string of middle- and small-sized coal mines will also be under accelerated construction. By the year 2000, the coal output of the whole region will reach 130.7 million metric tons.

Coal comes first, electricity follows. In the Seventh 5-Year Plan, under national support, the region adopted many means of collecting funds to get electricity, and the electric power industry developed vigorously. Installed capacities of the Baotou No 1 and No 2 heat and power plant, and the Wulashan, Fenzhen, Yuanbaoshan, and Tongliao power plants were, respectively, 412,000 kW, 425,000 kW, 200,000 kW, 400,000 kW, 900,000 kW, and 800,000 kW. By the end of 1990, the total installed capacity of the whole region was up to 3.8 million kW, an increase of 1.37 million kW, or 35 percent, over the Sixth 5-Year Plan. In the Seventh 5-Year Plan, the region generated 56.94 billion kWh, an increase of 116 percent. By the end of the Eighth 5-Year Plan installed capacity for electric power for the whole region will be 5 million kW. In the next 10 years, the region will increase installed capacity by 11.65 million kW, or 3.4 times what it was for the previous 41 years.

Big Energy Base Planned in North

40100006E Beijing CHINA DAILY (Economics and Business) in English 16 Nov 91 p 2

[Article by Zhang Yu'an and Gao Qingming]

[Text] Hohhot—China has worked out a multi-billion yuan investment plan to turn Inner Mongolia Autonomous Region, a remote and economically backward area inhabited by more than 21.6 million people of 49 different nationalities, into an important energy base within the next decade.

Wu Jian, president of the Inner Mongolia Branch of the People's Construction Bank of China, yesterday said total investment would be about 30 billion yuan ($5.66 billion) in the 1991-95 period, an unprecedented sum for this vast region which shares a 4,200-kilometre border with the Soviet Union and the People's Republic of Mongolia.

Wu said the money would be spent on constructing six large coal mines, five thermal power stations, each with an electricity generating capacity of more than one million kilowatts, and two coal transport railways in the region.

Inner Mongolia, believed to be the second richest coal area after Zinjiang Uygur Autonomous Region in Northwest China, has a recorded coal deposit of 198.9 billion tons and estimated reserves of some 1,000 billion tons.

Being worked on at the moment in the region are six coal mines with deposits of more than 10 billion tons each,

nine coal mines with a deposit of one to 10 billion tons each and 10 coal mines each with a deposit of 100 million to 1,000 million tons, Wu said.

Thus, the State has decided to inject billions of yuan into the region to make Inner Mongolia the second largest coal producer after Shanxi Province by the end of the century, Wu said.

This is expected to give a vigorous push to the development of the region's local economy, Wu said.

The goal is to increase Inner Mongolia's annual coal output from 46 million tons in 1990 to 130 million tons in the year 2000.

Wu's branch is responsible for handling State investment in capital construction projects and last year alone, managed 2.7 billion yuan ($509.4 million) investment in the region from central government, Wu said.

The coal mines under construction were the Dongsheng-Shenfu, the Zhunge'er, the Yiminhe, the Huolin, the Baotou and the Wuhai coal mines.

Among them, the Dongsheng-Shenfu Coal Mine, located in southwestern Inner Mongolia and northern Shaanxi, is China's largest open-pit mine with a proven reserve of 233.6 billion tons, one of the seven largest in the world, Wu said.

Thermal power stations will be located in Yiminhe, Yuanbaoshan and Tongliao in eastern Inner Mongolia, and in Dalata and Fengzhen in the west of the region, Wu said.

The Dalata Thermal Power Station on the upper reaches of the Yellow River and not far from the Dongsheng-Shenfu Coal Mine, was designed to be Asia's largest, with an electricity generating capacity of 5 million kilowatts, Wu said.

By the end of this century, the total electricity generating capacity in the region will rise to more than 10 million kilowatts from last year's 3.84 million kilowatts.

And the majority of the electricity generated by the region's power stations will be sent to other areas in China, Wu said.

East China To Build Its First Big Pumped-Storage Station

926B0019A Shanghai JIEFANG RIBAO in Chinese 16 Sep 91 p 3

[Article by Zhang Huiming [1728 6540 2494] and Chen Wei [7115 3262]: "State Planning Commission Formally Approves Construction of East China's First Large Pumped-Storage Power Station Located at Tianhuangping In Anji County, Zhejiang That Will Help Improve the Quality of Power in the East China Grid"]

[Text] The State Planning Commission formally approved construction of Tianhuangping Pumped-Storage Power Station, the first large-scale pumped-storage power station in the East China Grid, on 15 September 1991. The feasibility research report and preliminary design for the power station have been examined by the Ministry of Energy Resources and it passed assessment by the China International Project Consulting Company.

This pumped-storage power station is located in Anji County in northwestern Zhejiang Province. It has a superior geographical location, 175 kilometers from Shanghai, 180 kilometers from Nanjing, and 57 kilometers from Hangzhou, and it is near power use load centers, which will aid in interconnection with the 500 kV primary power transmission network of the East China Grid. The construction scale of the power station is 1,800MW, which will involve installation of six 300MW pumped-storage generators. Foreign investments will be used for the primary generators and key equipment, and the scale of construction is the largest in China.

Construction of Tianhuangping Pumped-Storage Power Station is extremely important for improving grid operating conditions and increasing the quality of power. At present, there are frequent power shortages during peak power use periods in the East China Grid while there is electricity to spare during valley power use periods at night. The peak-to-valley differential in the East China Grid in 1991 has reached 5,411MW. With the continual growth of power use in all industries and activities and the startup of several thermal power generators that lack sufficient regulation capacity, the contradiction between power use peak regulation and valley filling in the East China Grid has become more acute and prominent. After Tianhuangping Pumped-Storage Power Station is completed, it can use its generators, which will have both power generation and water pumping capabilities, and the surplus electric power in the East China Grid during the nighttime to pump water impounded in a reservoir at a lower position into a reservoir at a higher position and convert electrical energy into hydraulic energy. During daytime peak power use, the hydraulic energy stored in the upper reservoir will be re-released into the lower reservoir and converted into electricity. In this cyclical fashion, the power grid's peak regulation and valley filling capacity can be increased by 3,600MW each day.

The construction capital required for Tianhuangping Pumped-Storage Power Station will be raised jointly by the State Energy Resource Investment Company, Shanghai Municipality, and Jiangsu, Zhejiang, and Anhui provinces.

Outlook Bright for Development of Qinghai Portion of Huang He Mainstream

926B0019B Xining QINGHAI RIBAO in Chinese 2 Oct 91 p 1

[Article by trainee Xu Jianhua [1776 1696 5478] and reporter Dong Pei [5516 1014]: "Beautiful Prospects for Developing Hydropower on Trunk of the Huang He in Qinghai Province, After the Completion of Longyang Gorge Hydropower Station, Five Additional Power Stations Will Tower Over the Gorges of the Huang He"]

[Text] After more than 30 years of exploration, planning, design, and construction, beautiful prospects have appeared for the development of hydropower resources on the section of the trunk of the Huang He in Qinghai Province: after Longyang Gorge Hydropower Station is completed and begins generating power and construction starts at Lijia Gorge Hydropower Station, another four large-scale hydropower stations will tower over the gorges of the Huang He. The preliminary design reports and feasibility research reports have already passed examination for three of these hydropower stations and with this the cascade development configuration on the Qinghai section of the upper reaches of the Huang He, one of the key hydropower base areas China will develop, has taken initial shape.

The stubborn and intractable, surging and thundering Huang He runs for a length of 1,983 kilometers inside the boundaries of Qinghai Province. It has 17,990MW in developable hydropower resources that could generate a perennial average of 77.2 billion kWh of electricity. It has been called a "motherlode" of hydropower resources. After the 2nd Session of the First National People's Congress in 1954 examined and approved the development principle of a focus on power generation for the Qinghai section of the upper reaches of the Huang He, relevant departments of the state began uninterrupted on-the-spot survey, planning, exploration, and design work for the Huang He in Qinghai Province. After more than 30 years of braving the wind and rain and arduous surveying, the Northwest China Survey and Design Academy in the Ministry of Energy Resources submitted its "Report on a Cascade Development Program for the Longyang Gorge to Qingtong Gorge Section of the Trunk of the Huang He" in 1983 and unfolded a grand plan for developing cascade hydropower stations on the trunk of the Huang He in Qinghai Province. These are the six large hydropower stations already completed, now under construction, and to be built: Longyang Gorge Hydropower Station, Laxiwa Hydropower Station, Lijia Gorge Hydropower Station, Gongbo Gorge Hydropower Station, Jishi Gorge

Hydropower Station, and Sigou Gorge Hydropower Station. The total installed generating capacity of these hydropower stations will be 9,750MW and their perennial average power output will be 30 billion kWh.

The start of construction at Longyang Gorge Hydropower Station in 1976 opened the curtain on the development of large hydropower stations on the trunk of the Huang He in Qinghai Province. This "tap" hydropower station, which took 13 years of arduous effort for complete operationalization and power generation, was the first high dam in China and had the largest reservoir region. The advantage of the 5.97 billion kWh of power generated each year on the average by its four generators have become Qinghai's resplendent pearl on the upper reaches of the Huang He. Subsequently, construction got underway at Lijia Gorge Hydropower Station in 1987, the third cascade power station planned for the upper reaches of the Huang He. After 4 years of struggle by thousands of engineering and technical personnel and construction personnel, the "three openings and one levelling", large-scale temporary facilities, and other preparatory projects have basically been completed for this large power station, which will have an installed generating capacity of 2,000MW and generate a perennial average of 5.9 billion kWh of power. After diversion of the flow in October 1991, the entire project will enter the stage of a high tide in comprehensive construction of the main aspects of the project. The first generator is expected to go into operation and generate power in 1996 and all four generators in the first phase of the project will go into operation and generate power in 1998. At the same time, the preliminary designs and construction designs are now proceeding with urgency for Laxiwa Hydropower Station, the second cascade power station on the upper reaches of the Huang He, for Gongbo Gorge Hydropower Station, the fourth cascade power station, and for Jishi Gorge Hydropower Station, the fifth cascade power station. Evidently, construction will begin during the Eighth 5-Year Plan on either Laxiwa or Gongbo Gorge Hydropower Station. The golden age of hydropower development on the trunk of the Huang He in Qinghai Province is just around the corner.

Based on practice and experience in exploration and construction, development of hydropower on the trunk of the Huang He in Qinghai Province has advantages like a rather substantial and stable amount of water, good geological and topographic conditions, small inundation losses, sufficient natural construction materials, small amount of engineering, small investments, short construction schedules, substantial economic benefits, and so on. The completion of these hydropower stations will lay an excellent foundation for developing the chemical, metallurgical, and saline chemical industries and the large energy-consuming non-ferrous metals industry in Qinghai Province and northwestern China. In addition to developing hydropower resources, we can also make full use of the water resources of the Huang He to develop agriculture in the Huang He river valley region and the eastern part of Qinghai and to develop the aquatic breeding industry in the reservoirs and tourism on the plateau. The emergence of the metallurgical industry led by Qinghai Aluminum Plant and the rise of the aquatic breeding industry in the Long Yang Gorge reservoir have already begun to reveal the enormous economic benefits and social benefits from developing hydropower on the trunk of the Huang He in Qinghai Province.

Provincial Government Takes Extraordinary Steps To Speed Work on Manwan

926B0028B Kunming YUNNAN RIBAO in Chinese 20 Sep 91 p 1

[Excerpt] A series of important decisions were made in the province's Manwan Project Engineering Coordination Meeting which ended yesterday. Li Shuji, deputy provincial governor of the province said: "The meeting will have a great effect on promoting power generation by the end of next year."

Since work began on the Manwan Project, 742 million yuan have been invested, 93 percent of the excavation work has been completed, 803,900 cubic meters of concrete have been paved in the building of the main dam, buildings and reservoir base, which is equivalent to 37.2 percent of the engineering work. The engineering work has now entered the peak critical phase of concrete work and metal structural member installation. In the first 8 months of this year, 391,000 cubic meters of concrete were poured. However, with a shift in engineering focus, together with the not-too-smooth relationship among the different parties involved, an insufficient work force, and the rainy season, progress on the project has slowed. Therefore, Lu Youmei, deputy minister of energy, invited the leadership of the three engineering bureaus involved in the construction work to come to Beijing in early September to discuss the progress of the work. Duputy Minister Lu Youmei, together with Yao Zhenyan, general manager of the National Energy Investment Corporation, put forward a series of measures to accelerate the work on the station. At the same time, two responsible comrades were dispatched to the site to coordinate the work.

At the meeting, it was mentioned that accelerating the work on the Manwan Project carries important and far-reaching significance both economically and politically. At present, objective factors hampering work progress have been basically removed. As long as the management, design, and the actual engineering work can be coordinated and pushed forward with full cooperation from all parties, accelerating the construction of the power station is likely.

In the meeting, it was reaffirmed that the goal of completing 700,000 cubic meters of concrete work would not be changed; 300,000 or more cubic meters of concrete must be mixed and poured between September and December of this year. Thed goal has been conveyed to

the various engineering bureaus. The engineering management team will evaluate work progress very stringently according to actual work done. At the same time, it was decided that an Engineering Command Headquarters would be set up under the leadership of the Gezhouba-Manwan Engineering Bureau and Yi Yingtang, deputy bureau chief of the Gezhouba Engineering Bureau, was appointed its commander. Various engineering bureaus and their work will be centrally organized under his leadership. [passage omitted]

Manwan Update

926B0013B Kunming YUNNAN RIBAO in Chinese 4 Sep 91 p 2

[Text] The Manwan hydropower station which is located within the boundaries of Yun Xian in Lincang Prefecture and the Jingdong Yizu Autonomous County in Simao Prefecture, is in the first stage of construction in the plan to develop the cascades of the middle reaches of the Lancang River. The planned scale of the initial stage is for an installed capacity of 1,250 MW, and when the final stage at the Xiaowan power station is completed it will increase to 1,500 MW. A guaranteed power output in the initial period will be 352 MW, an annual output of 6.3 billion kWh, and final period guaranteed output of 780 MW and an annual output of 7.8 billion kWh. This power station is being built to solve the electric power needs of Yunnan's Eighth 5-Year Plan for the phosphorous chemicals and salt chemicals industries, and nonferrous metals raw and processed materials industries. It is a joint venture project of the former Ministry of Hydroelectric Power (now the Ministry of Energy Resources) and Yunnan Province. Investment in the power station portion of the project will be 1.013 billion yuan. The Ministry will invest 713 million yuan, and Yunnan Province will invest 300 million yuan. During the Seventh 5-Year Plan an investment of 650 million was already made, of which the Ministry invested 230 million yuan, and the province invested 415 million yuan. 470 million yuan was invested for the construction of the 500,000 volt transmission line from Manwan to Anning/Caopu, of which the Ministry's investment was 334 million yuan and Yunnan Province's investment was 136 million yuan. The power station is struggling to bring the first 250,000 kW unit on line in 1992, and for the entire project to become operational during the Eighth 5-Year Plan.

Lijiaxia Update

926B0028C Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 14 Oct 91 p 1

[Text] At 11:00 this morning, water in the 50-meter wide V-shaped valley on the upper course of the Huang He rushed into a 1,146.5-meter-long tunnel, signifying the successful blocking of the river at the Lijiaxia hydropower station, a key engineering project in the Eighth 5-Year Plan.

The upper course of the Huang He, from Longyang Gorge to Qingtong Gorge, stretches for 1,023 kilometers and drops 1,405 meters. It is one of the 12 hydropower bases in China. The plan calls for the construction of 15 large cascade hydropower stations. The Lijiaxia station is the third in the series of stations. It is situated on the border between Jainca County in Qinghai Province and the Hualong Huizhu Autonomous County, and about 108.6 kilometers from the first hydropower station in the series, the Longyang Gorge hydropower station. A power-generation capacity of 2 million kilowatts will be installed in the station and average annual power generation will be around 5.9 billion kilowatt-hours.

Construction of the Lijiaxia hydropower station first began in July 1987. The project is a joint capital venture between the central government and local provincial governments of Qinghai, Gansu, Shaanxi, and Ningxia and is the first of its kind involving joint capital in the nation. The first power generator is expected to be completed and started operating by 1995.

Development of Hutiao Gorge on Yunnan's Jinsha Jiang Placed on National Agenda

92P60025A Kunming YUNNAN RIBAO in Chinese 21 Oct 91 p 1

[Text] From 6 to 8 October, 31 hydropower experts and specialists from the National Ministry of Energy and the Design and Planning Bureau of the Water Resources Ministry conducted an on-site inspection of the Upper Hutiao, Lower Hutiao Gorge and the future Hutiao Gorge hydropower station and reservoir area. In the evening of 8 October, the specialists and experts held talks with the political commissar and administrators, local government leaders of the Dixing Autonomous Region and of the Lijiang Autonomous County. During the talks, Zhu Erming, chief of the Design and Planning Bureau of the Ministry of Water Resources said: "Hydropower resources on the middle course of the Jinsha Jiang is one of the 12 major hydropower resources of China. The relevant ministries and departments proposed development of Hutiao Gorge as early as the 1950's and a lot of work was done on it. However, due to economic factors and technical reasons, the development of the area was shelved.

At present, of the 12 major hydropower areas in China, the Jinsha Jiang is the only remaining one not yet developed. The inspection was done in accordance with national overall planning. Through on-site inspection, it is hoped that the planning phase of the development project can be completed during the Eighth 5-Year Plan period and the actual exploration and design work can be completed during the Ninth 5-Year Plan period. It is hoped that the Hutiao Gorge engineering project will be implemented as soon as possible.

Work Begins on 300MW Daxia Station in Gansu

926B0025B Lanzhou GANSU RIBAO in Chinese 17 Oct 91 p 1

[Excerpt] At 4:40 p.m. on 15 October, with a thundering roar, 1.5 tons of explosives lifted away half of a hill and sent pillars of water from the Huang He into a sky filled with dust and water. With this, work on one of the key national projects for the Eighth 5-Year Plan period, the Daxia hydropower station, officially began. It symbolizes the implementation of the development of energy resources along the Huang He's three little gorges in Gansu Province.

The "three little gorges" on the Huang He refer to the Xiaoxia Gorge, Daxia Gorge, and the Wujin Gorge, all located on the stretch of the river from Lanzhou to Jingyuan. The Daxia hydropower station is located in Baiyin, about 65 kilometers from Lanzhou. The dam is about 70 meters high and 241 meters in length along the top of the dam. Four generators will be installed and each will have a capacity of 75,000 kilowatts, making a total capacity of 300,000 kilowatts. On completion, annual power output can reach 1.465 billion kilowatt-hours. This will greatly improve and expand irrigation areas to 130,000 mu. It is a major water resources development project aimed mainly at generating electric power and also addressing irrigation and navigation needs. According to the engineering plan, water flow will be blocked towards the end of next year and the first generator will be put into operation in 1995. Total investment for the engineering project will be 980 million yuan.

Developing the "three little gorges" is a strategic measure in the development of Gansu Province's energy resources. The provincial government established on 28 August 1991 a Coordination and Steering Committee on the Development of the Huang He Three Little Gorges Hydropower Resources. The leadership in the Coordination and Steering Committee responsible for engineering work decides to first build the Daxia power station and then to develop the Xiaoxia and Wujinxia stations consecutively. It is estimated the completion of the three power stations will take 10 to 12 years. [passage omitted]

Outlook Good for Construction of Big Jishixia Project

926B0013D Xining QINGHAI RIBAO in Chinese 21 Aug 91 p 1

[Article by Xu Jianhua [1776 1696 5478] and reporter Dong Pei [5516 1014]]

[Text] The feasibility study for the 5th large-scale cascade power station programmed for the Qingduan cascade in the mainstream of the Huang He, the Jishixia hydropower station, passed appraisal and acceptance on 19 August at Xining. This report, supported by the Ministry of Energy Resources, Ministry of Water Resources' Water Resources and Electric Power Planning and Design Academy, and the Qinghai Planning Committee, was passed after 5 days of discussion by over 110 experts and representatives from 32 organizations including the National Energy Resources Investment Corporation, Huadong Survey and Design Academy, Gezhouba Engineering Bureau, and the Qinghai Provincial Government.

The Jishixia hydropower station is to be built in Xunhua County at the outlet of Jishixia, 30 kilometers from the Xunhua County Seat and 206 kilometers from Xining. The power station feasibility study completed by the Northwest Survey and Design Academy states that the main purpose of the key project is to produce electricity, the highest dam is designed to be 100 meters, the capacity of the main reservoir will be 273 million cubic meters, the installed capacity will be 1,000 MW with a guaranteed output of 332 MW and an average annual power output of 3.408 billion kWh. The experts and representatives who participated in the appraisal, having examined the site of the dams and reservoirs and exhaustively analyzed and verified indicators of the engineering level and design standards delineated in the feasibility study such as, hydrology, silting, environmental impact, engineering geology, and investment estimates, agreed that this power station's engineering is first class, and the design of the main structures is first class; it is designed to withstand a grade-7 earthquake, and the water barriers and sluice structures are designed to last 500 years.

The experts all regard the Jishixia power station as one of the backbone power stations for hydropower resources on the upper reaches of the Huang He. Because there is little head variation, utilization will be steady and the generation efficiency will be great; transportation is convenient; engineering conditions are excellent; the reservoir will cause little inundation damage, and there are good technological and economic indicators, therefore it is an ideal spot for a power source and is amenable for an early opening. After this power station is built it will be brought into full use for peak activity periods in the northwest grid, and for stimulating economic development in the Qinghai Province minority people's areas, especially the Xunhui Salarzu Autonomous County. The estimated total investment of over 1.3 billion yuan can be recouped within 10 years after the station becomes operational. It is reported that the appraisal and passing of this power station feasibility study report indicates that the early stages of preparation for the construction of five large-scale hydropower stations at Qingduan on the upper reaches of the Huang He in Qinghai are already completed.

Construction Accelerated on Guangzhou Pumped-Storage Station

926B0013C Guangzhou NANFANG RIBAO in Chinese 7 Oct 91 p 1

[Article by reporters Huang Chihe [7806 3589 0735] and He Hongwei [0149 3183 0251]]

[Excerpt] Construction of the Guangzhou pumped-storage power station, a national key construction project, is being

accelerated. The 20-kilometer stretch of highway up the mountain which connects the upper and lower reservoirs has been completed; only .4 kilometers of the 14.8-kilometer tunnel remains to be completed; 1.2 million square meters of rock for the underground power house has already been excavated, and the penstock and the spiral casing for the No 1 hydraulic turbine are being installed; the main dam for the upper reservoir is 75 percent completed; the excavation of the lower reservoir is finished and the concrete for the dam foundation is being poured. It is foreseen that the No 1 turbine will begin generating power in the 4th quarter of next year. [passage omitted]

Ningbo Becoming Thermal Power Base

926B0015B Beijing RENMIN RIBAO in Chinese 25 Sep 91 p 1

[Text] With the rapid completion of a large thermal power plant backed by a large port, China's famous port city, Ningbo, has become the latest thermal power base in the East China Region. For the Zhenhai Power Plant, construction of which began almost at the same time as that of Beilun Harbor, 1979 saw the completion of the first 125,000-kilowatt generator. After two subsequent phases of expansion, total power generation capacity of the power plant has now reached 1.05 million kilowatts. As one of the large thermal power plants under construction in China, Ningbo's Beilun Harbor Thermal Power Plant has begun to send power into the grid with the completion of a 600,000-kilowatt generator in March of this year as phase I of the project. In the first half of the year, Ningbo City's total power generation capability reached 1.80 million kilowatts, and thus has made the city the largest power-exporting area in Zhejiang Province.

Weihe 300MW Unit Joins Grid

926B0013A Xian SHAANXI RIBAO in Chinese 7 Sep 91 p 1

[Article by correspondent Han Xiaoshi [7281 1420 1102] and reporter He Tao [6320 7290]]

[Excerpt] The largest electric power generating unit in Shaanxi, the Weihe No 3 300 MW unit, successfully completed its test run at about 10 a.m. on 6 September and has joined the grid to begin generating power.

The expansion of the Weihe power plant is a national key energy construction project, and is Shaanxi's first national-provincial cooperative engineering project. Shaanxi contributed 70 percent of the total investment. Four 300 MW units will be installed for a total installed capacity of 1,200 MW. The main system for the No 3 unit in the initial period of construction will be totally Chinese manufactured facilities with a fairly high level of automation, including automated controls for the boiler ignition and monitoring system. The installed capacity will equal 50 percent of all of the installed capacity under construction in the province this year. Once on line, the power output will increase 2.16 billion kWh each year, which will alleviate the power shortage situation in Shaanxi.

The workers and staff of the Shaanxi Power Construction No 3 Corporation who undertook the overall engineering and installation work with assistance of fraternal elements at the Weihe power plant, followed the call of Chief Weng to use first-rate technology, build a first-rate power plant with first-rate engineering, guarantee first-rate quality, and to overcome every obstacle to assure the installation of a quality facility. After the boilers were fired up for a test run on 25 July, no major problems were encountered, and it surpassed the average level of quality performance of other units of like capacity elsewhere in the country. [passage omitted]

Hualu Update

926B0015C Beijing JINGJI RIBAO in Chinese 15 Jul 91 p 1

[Text] After more than a year's hard work, one of China's key engineering projects, the Dezhou Hualu Power Plant, has tested its first 300,000-kilowatt generator. Shandong Electric Power Engineering Company No 2, which is constructing the Hualu Power Plant, and, while doing the test runs on the first generator, is also accelerating installation work on the second generator. Workers there are determined to break a new record in meeting schedules and work quality in the installation of two Chinese-made 300,000-kilowatt generators.

Shidongkou No 2 Plant Completed

92B0015A Shanghai JIEFANG RIBAO in Chinese 4 Oct 91 p 1

[Text] One of China's key engineering projects, the Shidongkou No 2 Power Plant, where, if work was 1 day behind schedule, it would mean a loss of US$84,000 in interest payments and 1 day ahead of schedule would mean the capability to generate 28 million dollars of profits for the country, was finally completed right on schedule yesterday after workers of the Shanghai Electric Power Installation No 1 Company had worked for over 38 months.

The Shidongkou No 2 Power Plant, located in Shanghai on the south bank of the Yangtze River, is China's first thermal power plant with a super-critical 600,000-kilowatt capacity. It is also a key engineering project financed by foreign investment. The power plant will have great significance in relieving the power crunch in East China and the Shanghai area.

Phase I of the project involved the construction of two 600,000-kilowatt generators with an expansion capability to build two more 600,000-kilowatt generators. The Shanghai Electric Power Installation No 1 Company, which undertook the construction work on this high-technology, high-specification, modern power plant, had many difficulties. First, the working conditions for installing the boilers were poor, involving a lot of work high above the ground where many joints had to be matched and welded. The second difficulty was the city's so-called strategic engineering item, the "installation of spiral water coolers." In the past, in similar installations in China, distortions and misalignments of over 100 millimeters have occurred. This will adversely affect the installation quality of the whole boiler. The third difficulty is the installation of heat-control equipment. The generation capacity is large, the coefficient is high, and the technology is new; the level of automation is high and also this is the first time such an engineering project has been undertaken, so the difficulties grow

correspondingly. The fourth difficulty is the super-critical-capability generators. Compared with ordinary generators, these super-critical generators require far more welding. Most welding work involves steel alloys and over 10 different kinds of these alloys are involved. Moreover, the tubes requiring welding are over 837 millimeters in outer diameter and the thickest tubes are 136.5 millimeters in thickness. There are also other difficulties involved in the construction of the Shidongkou No 2 Power Plant. In fact, they are simply too numerous to list.

Over 2,000 workers and technicians of the Shanghai Electric Power No 1 Company fully exemplify the spirit of determination and hard struggle typical of Chinese workers to brilliantly finish the installation work. An example is the French-supplied 220,000-volt oil-filled cable. The foreign supplier specifies that during installation the traction force on the cable should not exceed 4 tons and lateral pressure should not exceed 0.5 ton. With the use of new installation skills, the workers were able to reduce the traction force and lateral pressure to 0.2 ton and 0.17 ton respectively, thus guaranteeing the success in the installation of the US$172-per-meter oil-filled cable at the first trial. In the welding of a super large tube, eight welders took turns welding for a total of 40 hours non-stop. A female welder weighing less than 50 kilograms used up 130 kilograms of solder during the welding of a large tube.

As quality control was tightened during the construction phase, hundreds of joints were examined with a one-time welding passing percentage of 96.55 percent.

At present, only a few countries, such as United States, USSR, Japan, and Germany have 600,000-kilowatt super-critical generators. The first-time installation of this generator reached a level of quality and technical skill that earned the country's silver award for outstanding engineering projects. Because of this, the world-famous ABB [Asea Brown Boveri] sent a message of congratulations for the good work and some installation workers of Shanghai Electric Power No 1 Company were even invited to have meals with the foreign experts in hotels.

Oil Output To Hit 137 Million Tons in 1991

92P60089 Beijing RENMIN RIBAO OVERSEAS EDITION, 19 Nov 91

[Summary] Beijing, XINHUASHE 18 Nov—The China Petroleum and Natural Gas General Corporation has announced that the nation's oil production in 1991 will hit 137 million tons; natural gas production will be some 14.7 billion cubic meters.

By the end of last month [October], petroleum production had met 83.5 percent of the year's target; natural gas production had met 84.75 percent of its yearly goal. Both of these figures represent a breaking of the originally tasked production rate.

Prospects for Biogenic Gas Development Discussed

926B0017 Beijing ZHONGGUO DIZHI [CHINA GEOLOGY] in Chinese No 10, 13 Oct 91 pp 23-25

[Article by Xie Qiuyuan [6200 4428 0337] of the Ministry of Geology and Mineral Resources Petroleum Geology Institute: "Development Prospects for China's Biogenic Gas Resources"]

[Text]

I. General Characteristics of Biogenic Gas

Natural gas is a superior quality energy resource and a raw material for the chemical industry, and it has attracted special attention. From 1980 to 1985 alone, world output of natural gas and its proportion of the structure of energy resource consumption both grew by 14 percent. China's natural gas reserves and output have grown substantially over the past several years. While the Ministry of Geology and Mineral Resources has been exploring for petroleum, it has also continually strengthened natural gas exploration and made successive major breakthroughs.

Natural gas is divided into three categories based on differences in formational factors: biogenic gas, pyrogenic gas (gas associated with petroleum, coal-formed gas, etc.), and deep source gas (gas released from the mantle and other non-biological formational factors).

Biogenic gas is a combustible hydrocarbon formed by degradation of the organic matter in sediments by anaerobic microorganisms in a reduction environment during the early period of lithification. Having a methane content of 90 to 99 percent and containing extremely few heavy hydrocarbons, and having a high concentration of light C isotopes ($\delta^{13}C<-55$ percent) are two important characteristics used to identify biogenic gas. The heavy hydrocarbon content can exceed 2 percent only when it is mixed with pyrogenic gas. There is more CO_2 in continental facies sediments. The Quaternary biogenic gas in Tarim, Qinghai, for example, has a methane content of 98.9 percent, a heavy hydrocarbon content of 0.09 percent, and -6.64 percent $\delta^{13}C$. The methane content of Quaternary biogenic gas in the Chang Jiang Delta is 91 to 95 percent, and it is 0.8 percent heavy hydrocarbons, 4 percent CO_2, and -7.36 percent $\delta^{13}C$. Tertiary biogenic gas from Cook Inlet in the United States has a methane content of 98.7 percent, and is 0.23 percent heavy hydrocarbons and -6.07 percent $\delta^{13}C$ (Bao Ci [0545 5412], et al., 1988).

Another characteristic of biogenic gas is that it was formed, accumulated (mineralized), and buried at relatively shallow depths. Biogenic gas accumulations can be found from 10-plus meters or a few 100 meters to about 1,000 meters. The generation strata are from several periods, including the Tertiary and Quaternary, and the oldest is the Cretaceous (there are also reports of biogenic gas indications in the Devonian system). The reason is that after biogenic gas is formed, it is not easily preserved for long periods. Generation and reservoiring of biogenic gas in shallow strata is a prominent characteristic of its mineralization. Over the past 20 years, several 10 relatively large-scale gas deposits discovered in the world have been confirmed to be biogenic gas. Only then was biogenic gas treated as a resource target with development prospects and research and exploration were strengthened.

At present, achievements that have attracted attention have been made in scientific experiments and research on biogenic gas formation mechanisms, factors that affect its generation, formation and reservoiring conditions, resource potential, and other areas. The general feeling is that large amounts of biogenic gas can be generated in surface strata sediments. The temperature limit for the formation and breeding of microorganisms is 70°C. The mirror bodies corresponding to this temperature in the Tertiary system of east China have a reflectivity Ro<0.35 percent, so this can be used overall as the limit for biogenic gas generation. The Ministry of Geology and Mineral Resources Petroleum Geology Institute and Ministry of Agriculture Chengdu Biogas Institute have cooperated in conducting laboratory simulation experiments on biogenic gas formation. They obtained organic matter from different categories of sediments. Their total gas output from 35°C to 65°C was 31 to 91 m^3/ton of organic matter (the number of cubic meters of gas produced by each ton of organic matter). The generation of biogenic gas is controlled by temperature, pressure, water quality, water body environment, category of organic matter (the comprehensive product of sediment source, rate, and environment), and other factors. Organic matter of categories I, II, and III can form biogenic gas in either marine, continental facies, or arid-moist environments.

Substantial achievements have also been made in exploration. Total proven biogenic gas reserves in foreign countries now account for nearly one-fifth of total proven reserves of natural gas reserves. China's proven biogenic gas reserves account for 6 percent of our total proven natural gas reserves. Because biogenic gas accumulations are at shallow depths, experiment and development costs are low and the economic benefits are

good, so they are attracting growing attention from people. On the other hand, because biogenic gas is easily dissipated in large amounts after being formed in large amounts, the understanding of its mineralization laws is shallow and there are many problems in exploration, so more intensive research is needed.

II. Development Prospects for China's Biogenic Gas Resources

An outline of resources, exploration, and development. Surveys were conducted of shallow strata gas (mainly biogenic gas) in the middle and lower reaches of the Chang Jiang during the late 1950's. Several biogenic gas deposits with industrial value were discovered in the last 10 years distributed in several Mesozoic and Cenozoic basins of north China. More than 10 gas fields have been discovered so far, including five in Songliao Basin, one each in Bohai Bay Basin and Erlian Basin, and five in Qaidam Basin. Biogenic gas indications are common in several marine basins. The gas-bearing strata are the Quaternary system, Tertiary system, and upper Cretaceous system. Projections for 19 basins indicate total biogenic gas resources of 2.66 to 2.95 trillion cubic meters, equal to 7 percent of China's total natural gas resources. Marine basins account for 60 percent of our biogenic gas resources. Songliao has the most for continental basins and the Bohai Bay and Qaidam Basins are second (Wang Tingbin [3769 1656 2430], Zhang Hongnian [1728 3163 1628], et al., 1990). The extent of exploration is still rather low at present, but the resource prospects are not easily ignored.

Besides Songliao and Baohai Bay Basins, other basins of East China that have formed biogenic gas include Hehuai, Subei [northern Jiangsu], Nanxiang, Jianghan, Erlian, and Hailar basins, all of which have definite potential. Songliao Basin, which has the best prospects, has as much as 500 billion cubic meters in biogenic gas resources in the Sifangtai-Mingshui group, Nenjiang group, Yaojia group, Qingshankou group, and other generation-reservoiring-capping combinations. The primary direction of exploration is the Da'an-Taikang region in the northwestern part of the basin and the uplifts in the southeast and southwest parts of the central depression. The potential resources in the Bohai Bay Basin are second only to those of Songliao. Its primary gas-bearing strata are in the Tertiary system and biogenic gas accumulations have been discovered both in marine and continental areas of Bohai Bay. Like Songliao, it is also biogenic gas formed from the organic matter in freshwater semi-deep and deep lacustrine sediments. There is hope that biogenic gas may be found in Cretaceous system lacustrine sediments in Erlian and Hailar Basins.

In northwest China, the resource potential is greatest in Qaidam Basin, which is also the basin where the earliest discovery of biogenic gas gas-bearing regions was made in China, and daily single-well gas outputs can reach 300,000 cubic meters. The several gas fields already proven so far are from the Quaternary Pleistocene. They contain biogenic gas formed from abundant organic matter during the process of gradual salination of the lake water under an arid and semi-arid climate. Data and projections indicate that additional new gas deposits may be found. Similar conditions also exist in Junggar and Tarim Basins. Close attention should be given to shallow biogenic gas during exploration for oil and gas in deep areas.

China's marine areas are the most important distribution region for biogenic gas resources. The projected reserves are 500 billion cubic meters in the East China Sea and 1.2 trillion cubic meters in the northern part of the South China Sea. They were formed from the organic matter in shallow sea and deep sea facies sediments and may biogenic gas indications have already been discovered. All of the gas-bearing strata are from the Quaternary or Tertiary. The East China Sea is a Cenozoic Basin that mainly contains gas. It includes the organic matter in the Miocene and part of the Oligocene of the Xihu depression which is still in the low maturity metamorphosis stage. These are the primary generating and reservoiring strata for biogenic gas and there is hope that gas pools may be found in traps with suitable excellent capping strata. Santan depression and its nearby traps are the primary direction in future exploration for biogenic gas. Taixinan and Yinggehai Basins in the northern part of the South China Sea as well as Zengmu Basin are basins that mainly produced gas. The upper Miocene system to Pleistocene system there is semi-mature source rock mainly characterized by category III casein base (Taixinan Basin) and Pliocene shallow sea clastic rock (such as Zengmu Basin) that are biogenic gas sources, and there is hope that gas pools have accumulated.

The ancient Chang Jiang, ancient Huang He, and lower reaches of the ancient Zhu Jiang have shifted their courses many times. All of the organic matter in the fluvial and lacustrine sediments in the ancient channels may have generated biogenic gas. This has been confirmed by the discovery of several gas indications (such as gas strata in the Yancheng group at a depth of 955 meters at Zhou 2 well in Subei Basin, which produced a daily gas output of 170,000 cubic meters) in the lower reaches of the Chang Jiang and Zhu Jiang Delta. The deltas that formed where these ancient rivers entered the sea are ideal locations for the formation of biogenic gas.

In summary, one can see that the primary categories of biogenic gas pools found in China are: the saline lacustrine facies Qaidam type, freshwater lacustrine facies Songliao type, littoral-shallow sea facies South China Sea type, and fluvial and lacustrine facies ancient Chang Jiang type. They have rather substantial resource potential and several achievements have already been made in exploration. They have optimistic exploration prospects.

III. Ideas for Developing Biogenic Gas Resources

First, we should focus on exploration for biogenic gas resources and make them targets of exploration and a new area to open up. Although biogenic gas is both

generated in large amounts and dissipated in large amounts, the fact that it is buried at shallow depths and was formed during relatively recent periods means that it usually does not easily accumulate on a large scale. Its primary gas accumulation period was rather late, however, and some is still in a dynamic balance of generation and accumulation, so little has been destroyed by structural activity, the properties of reservoir strata are usually rather good, and it easily forms rich pools in local areas. Some can even form rather large scale gas pools (the western Siberian Basin, for example, has proven reserves of 1.3 billion cubic meters). Moreover, it is precisely because it is buried at shallow depths that it is easily explored, extracted, and utilized at rather low cost. In regions that have already been confirmed to have substantial resource potential and exploration prospects, especially in the economically developed regions of East China, exploration for biogenic gas should be included in plans to discover new gas deposits. Even if only small ones are found, they will be extremely important for reducing the energy resource shortages in the economically developed regions of east China.

Second, there should be more intensive research on the formational and reservoiring laws of biogenic gas and this topic should be included in scientific research projects to attack key problems related to natural gas. In the future, besides continuing to study the formational mechanisms and formational conditions of biogenic gas in China and its resource potential, we should also focus on studying the formational and reservoiring conditions of biogenic gas. The factors controlling the formation of biogenic gas pools that have been discovered in China and foreign countries should serve as a basis for analyzing the distributional laws of gas pools in some regions with resource potential like the rather large number of biogenic gas indications that have been discovered in the region of the middle and lower reaches of the Chang Jiang. Our shallow understanding of its distribution, generation, and reservoiring conditions is the main reason that our previous surveys have not produced better results. Further research in other regions where gas pools have been discovered (Songliao, North China, etc.) will inevitably produce new discoveries.

Third, research to attack key problems and practice in surveying should be used to form a set of special technologies for biogenic gas exploration, development, and utilization. The technologies and techniques involved in exploration, development, and utilization of biogenic gas deposits have special requirements and we should develop a set of technologies and techniques suited to China's geological conditions and social conditions.

Fourth, in the area of exploration deployments, we can adopt the deployment principle of combining deep and shallow areas, "leading away a goat in passing" [taking what is available], specialized tracking, and local utilization. Shallow strata biogenic gas is actually a new area. Because local structures are not well developed in shallow strata or distributed over large areas, exploration targets are hard to grasp. By combining exploration in both deep and shallow strata, focusing on shallow strata, and "leading away a goat in passing", we can form a set of important methods for biogenic gas surveying. Specialized tracking surveys based on chemical prospecting anomalies and gas seeps from shallow strata at the surface will be an economical and quick method. Combining them with a search for oil in shallow strata will provide continued confirmation that it is an effective way to increase success rates and economic benefits. It would be best to adopt a local utilization arrangement to exploit and manage shallow strata biogenic gas. Otherwise, unless there are large and medium-sized gas pools, it usually will be very hard to improve economic results. Thus, this point must be considered in deployments for biogenic gas exploration.

Development of Turpan-Hami Oil Field Beginning To Take Shape

926B0023B Zhengzhou HENAN RIBAO in Chinese 1 Sep 91 p 4

[Text] The world renowned Turpan-Hami oil field prospecting and development arena of western China has had a string of record-breaking developments, and the news has been pouring in from the various petroleum forces engaged in prospecting, drilling, extracting, and surface engineering and construction. A first-class, modern oil field is taking shape.

The field is located in the Turpan-Hami Basin of eastern Xinjiang. In this great expanse of territory it can be seen that the volume of petroleum resources makes this one of the main strengths of the Go West strategy of the China petroleum industry.

As respects oil prospecting, the four oil fields—Shanshan, Yilahu, Qiuling, and Wenjisang—that have already been discovered in the region confirm the existence of three major oil-producing rock series with average oil strata depths of up to 50 meters. The Shanshan oil field, situated on the south slopes of Huoyan Mountain, has proven reserves, and has fully moved into the production development stage. Qiuling oil field now has 13 exploratory wells and data on four others where drilling has begun. The test oil and gas contents from wells where drilling has been completed are cause for exhilaration. Directorate authorities believe that this oil field can become a 1-million-ton-class major oil field. On 21 August, oil workers, again, on the 30-square-kilometer Qiudong terrain, at No 3 exploratory well, discovered excellent signs of oil and gas. In addition to the oil fields found in the Tuha Basin, there are over 70 oil traps that show promise as oil fields.

In oil field development and construction, the Turpan-Hami petroleum prospecting and development arena directorate motivated to make Shanshan oil field into a national 1st-class oil field, and to turn Qiuling oil field into a world-class oil field, has called up crack troops and strong leaders throughout the country, have broadened the use of new technology, new processes, and new facilities in order to reach production capability quickly.

At Shanshan oil field, 72 wells have been completed, and 34 of those have gone into production. The application of 24 new techniques adopted from North China oil fields to design and construct the Shanshan combined oil extraction factory and station has made it a structure of superior engineering quality. Within a year it will have a 500,000 ton output capability, and 200,000 tons of crude oil will be produced in that year. On the south side of the Lan-Xin rail line, the 284 meter long loading platform, built by Yumen oil field, is the longest crude oil vehicle loading platform in China. It is largely completed, and will become operational on schedule. By the end of this year, the field will have 118 new wells in production overall, and the oil extraction and collecting system at the oil field are coming on line in good order.

Seismic Exploration for Natural Gas in Shaanxi-Gansu-Ningxia Basin

926B0023A Yinchuan NINGXIA RIBAO in Chinese 4 Oct 91 p 4

[Article by reporters Ma Jiqi [7456 7157 3823] and Li Yong [2621 0516]]

[Excerpts] The all-out battle to find natural gas in the Shaanxi-Gansu-Ningxia Basin is underway. A petroleum contingent of as many as 10,000 has opened up a great battlefield that stretches from the east at Hengshan, Shaanxi, west to Dingbian, and from Otog Qi, Nei Monggol southward to Huangling County in the vicinity of Yenan, an area of over 60,000 square kilometers. [passage omitted]

The Shaanxi-Gansu-Ningxia Basin spans the five provinces and regions of Shaanxi, Gansu, Ningxia, Nei Monggol, and Shanxi; its geological placement is on the North China platform; geotectonically, it is called the pericratonic basin, and it is rich in oil and gas. In 1907, China drilled the first oil well in northern Shaanxi. In the latter half of 1989 and first half of 1990, the Changqing Petroleum Prospecting Bureau drilled several exploratory wells in the Shaanxi-Gansu-Ningxia Basin and found high-volume yields of commercial grade gas, and this opened the curtain to natural gas prospecting in the basin. This year, the bureau had completed 28 wells by the end of September, of which 15 contained gas, and the majority of those produced high volume outputs of over 100,000 cubic meters per day. According to incomplete statistics, the central Shaanxi-Gansu-Ningxia Basin has available natural gas reserves of about 80 billion cubic meters, and the area of deposits under control is up to 2,000 square kilometers. This is a gas field discovery of unprecedented dimensions, and what's even more satisfying is that the extent of the central basin gas- bearing area has not yet been fully defined and is expanding constantly.

In order to continue to expand the prospecting effort for natural gas in the Shaanxi-Gansu-Ningxia Basin, in July of this year, the China Petroleum and Natural Gas General Corporation decided to combine the 22 seismic teams of the Changqing, Sichuan, Zhongyuan, and Jianghan petroleum bureaus, and the General Corporation's Geophysical Prospecting Bureau, and to unify deployment, methods, technical standards, and technical resources processing into a history making natural gas battle scene. In mid-August, the various seismic field forces took up their assigned positions and engaged their target. [passage omitted]

Milestone Reached in Laser Isotope Separation Technology

926B0026B Beijing RENMIN RIBAO in Chinese 27 Oct 91 p 1

[Article by correspondent Wen Hongyan [3306 4767 1750] from Tianjin: "Milestone Reached in Laser Isotope Separation Technology - Macro-Scale Collection of Enriched Uranium Successful"]

[Text] Macro-scale collection of enriched uranium by an atomic laser technique has been successfully developed by the Institute of Physicochemical Engineering for Nuclear Industry. This technology recently passed technical appraisal at the ministry level. This accomplishment is a leap forward in laser isotope separation, from signal quantity collection to macro-scale collection. It is a significant milestone in the development of laser isotope separation in China.

Experts confirmed that the abundance of macro-scale uranium collected is more than 3 percent. The collection rate is over 2 milligrams per hour. It can collect more than 5 milligrams each time (which can be seen by the naked eye and thus becomes macro-scale). In one separation, it meets the concentration requirement for the pressurized water reactor.

Enriched uranium is a basic nuclear fuel which requires to have more than 3 percent U-235 by isotope separation. In natural uranium, there is 0.7 percent U-235 and 99.3 percent U-238. Hence, separation enrichment technology becomes an important benchmark for the nuclear industry.

Atomic laser isotope separation of uranium is the third generation uranium enrichment technology after diffusion and centrifuge techniques. In other countries, it is considered a 21st century technology. Compared to other separation techniques, it is less costly in initial capital requirement, cheaper to operate, less power consuming, and more flexible in terms of production scale. It not only can be used to enrich natural uranium ore, but also can re-enriched spent fuel to fully utilize uranium. Furthermore, it is capable of extracting pure plutonium and mercury isotopes and has a very promising future.

After over 5 years of diligent work, we have independently developed all the major equipment for laser isotope separation. In addition, we have creatively solved a number of key technical hurdles in optics, uranium evaporation, ion collection and the system has reached world class level in terms of major technical specifications.

Start-Up of Qinshan Nuclear Power Plant Detailed

926B0018 Chengdu HE DONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 12, No 5, 10 Oct 91 pp 16-21, 29

[Article by Wang Riqing [3769 2480 3237] of Qinshan Nuclear Power Plant, Haiyan, Zhejiang: "Start-Up of Qinshan Nuclear Power Plant"; manuscript received 2 April 1990]

[Text] [Abstract]

This article describes the primary steps in the start-up process for Qinshan Nuclear Power Plant, analyzes the main limits in start-up, and discusses start-up safety questions.

Key terms: start-up, cold reactor shutdown, hot reactor shutdown, power operation, limits.

I. Start-Up Sequence

A nuclear power plant undergoes initial start-up experiments and operation after loading and can go into commercial operation after all required measurements, experiments, and repair projects are completed. Any subsequent restart process is called an operational start-up, normal start-up, or start-up.

Any transitions from a cold reactor shutdown operating condition to a rated power operating condition and the process are the content of the start-up regulations for Qinshan Nuclear Power Plant. The earliest state in start-up of Qinshan Nuclear Power Plant is the cold reactor shutdown operating state and the final state is rated power operation. Additional regulations are followed in long-term operations like fuel replacement and so on for the transition from a cold reactor operating condition to a cold reactor shutdown operating condition.

According to the regulations, the basic procedures or primary steps in normal start-up of Qinshan Nuclear Power Plant are:

A. Preparations for start-up

These involve inspection and confirmation that the states of all relevant systems satisfy requirements, especially the state of the primary and auxiliary systems in the primary loop, and confirmation that all important valve positions, especially the valve positions of the containment vessel isolation system, conform to regulations.

B. Preparations for temperature increases

The focus here is on completing preparations for start-up of the primary pumps, including inspection of the axial seal injection water and equipment cooling water supplies.

C. Starting to raise the temperature of the primary coolant system

Start-up of the two primary pumps and placing the pressure stabilization and electrical heating components

into operation includes proportional assemblies and reserve assemblies. The temperature of the primary coolant system is raised at a rate of about 30°C/hour. During the temperature raising process, because the positive moderator temperature reactivity coefficients may reduce the depth of reactor shutdown, operating personnel must cooperate closely with physical measurement personnel to ensure that the effective breeding coefficient of the reactor core always conforms to the requirements of the technical regulations, meaning that it must satisfy:

$$k_{eff} \leq 0.985$$

Before the temperature reaches 80°C, diamine is added to the primary coolant system. To achieve relatively optimum diamine deoxidation results, the reactor shutdown cooling system must be used. The temperature of the primary system is maintained within the 80 to 90°C range for about 4 hours. The purification bed must be bypassed during deoxidation of the added diamine. When the temperature of the primary system is being raised, the secondary side of the steam generator can be blown down and the water replaced until the specified water quality is obtained. Then, the auxiliary water supply pumps maintain the zero power water level.

D. Establishing a steam cavity in the pressure stabilizer

There are many ways to diagnose the pressure stabilizer steam cavity. In actual operation, two convenient methods are employed: 1) The top filling flow rate is shut down or reduced and the bottom drainage flow rate is increased and the pressure in the pressure stabilizer is basically maintained and does not drop. 2) The spray valve is opened manually and the pressure inside the pressure stabilizer drops rather quickly.

After the steam cavity is formed in the pressure stabilizer, the blanket gas N_2 in the volume control tank must be replaced with H_2. The bottom drainage low-pressure channel is switched to the normal channel. The reactor shutdown cooling system is switched to the safety injection reserve state. The pressure stabilizer pressure release valve operating state switch is shifted from "low pressure" to the "normal" position.

E. Primary system temperature raising and pressure raising

The temperature and pressure are raised in strict accordance with the stipulated "pressure-temperature relationship curve". During this process, the back pressure control valve is set on "automatic" and regulates the top filling flow rate and injection water flow rate of the primary pump axial seals. At the same time, it is confirmed that the temperature and pressure of the secondary side of the steam generator are rising at an appropriate rate. The steam supply condenser of an auxiliary boiler can also be used to inject steam into the air extractor, steam used to heat the deoxidizer, and steam used to seal the axles of the steam turbines.

F. Safety injection system placed into "reserve"

When the pressure of the primary system reaches 6.86 MPa, the safety injection tank is placed into "reserve". When the pressure reaches 12.74 MPa, it is confirmed that the "pressure stabilizer low pressure" and other safety injection signals are automatically restored and the safety injection system is placed into a "reserve" state. Prior to this, it must be confirmed that the pressure on the secondary side of the steam generator is no lower than the overall set value for "main steam pipe low pressure safety injection".

G. Confirmation of hot reactor shutdown state

When the pressure in the pressure stabilizer is 15.19 MPa, the liquid level in the pressure stabilizer is the zero power sequence water level, so the pressure and water level are both in an "automatic" control state. The temperature of the primary system is maintained at 280°C by the large air release valve or the main steam bypass discharge valve, so the bypass discharge valve is in a "pressure control" mode. The water level on the secondary side of the steam generator is still at the value required for zero power.

H. Operations to reach criticality

Criticality computations are made in conjunction with physical measurement personnel. For this purpose, appropriate criticality control rods are selected, reactivity equilibrium principles are used to determine the critical boron concentration, and boron release operations are carried out. Then, the control rods are lifted according to the specified sequence. First, two safety rods are raised and, based on the data provided by the physical personnel, it is ensured that the reactor is still subcritical after the two safety rods are raised to the top. Next, the adjuster rods are raised. During the rod raising process, an inverse counting curve must be used to examine the criticality computations and the predetermined actual critical rod positions and to ensure that they are within the permissible range for the provided rod positions. The reactor is moved to criticality at a rate no greater than 0.5 DPM (0.5 numerical grades/minute).

Since the point of physical criticality is hard to determine, operating personnel often use a convenient method to diagnose whether or not the reactor has become critical. After they finish raising the control rods, the neutron logarithmic counting indicator increases at a steady rate and rises in a straight line on the recorders. Or, the reactivity indicator indications and cycle table indicators are stable and unchanging.

The nuclear power is usually maintained at criticality for an intermediate measuring range of about 10^{-8} A for the

purpose of conducting various types of physical experiments and measuring the relevant parameters. At the same time, preparations are made for start-up of the steam turbines and generators.

I. Raising the power from 1 percent to 7 percent

The main steam isolation bypass valve is used to warm the primary steam pipes and the steam originally supplied by the auxiliary boiler is switched to the main steam supply.

The started-up primary water supply pumps replace the auxiliary water supply pumps and maintain the liquid level on the secondary side of the steam generator.

The main steam turbines can be raised gradually from a barring state up to 400 rpm for carrying out low-speed thrust rotation and warming. Afterwards, the speed is raised to the rated rotational speed of 3,000 rpm.

J. Raising the power to 15 percent

During the process of raising the reactor power, main steam bypass discharge is used to maintain a power equilibrium in the first and secondary loops. When the reactor power reaches 10 percent, the P-7 indicator shows that the reactor shutdown protection that was formerly locked has been automatically restored. When the reactor power reaches 15 percent, the generators can be connected to the power grid. Their initial output is about 5 percent of the rated value. The output of the generators is raised at the specified rate and simultaneously it is confirmed that the bypass discharge valve moves gradually from being slightly closed to completely closed. When the reactor power exceeds 15 percent, the bypass discharge automatic control can be shifted from a "main steam pipe pressure" mode to a "primary coolant average temperature" mode. The power regulation system, the rod control system, can be placed on "automatic" and the primary water supply is switched from single impulse control to triple impulse control.

K. Raising the steam turbine generator output to 35 percent

The steam isolation reheater (MSR) second-stage heated steam is placed into operation.

L. Raising the steam turbine generator output to 60 percent

The deoxidizer heated steam is switched from the main steam to fourth-stage steam extraction and the deoxidizer operates according to a sliding pressure pattern.

M. Raising the steam turbine generator output to 100 percent

A comprehensive inspection is made to confirm that the reactor systems and steam turbine generator systems are operating normally. Final determinations are made of the nuclear power and heat power. During the process of increasing output, it must be confirmed that the primary coolant average temperature T_{avg}, pressure stabilizer pressure, liquid level, steam generator secondary side liquid level, and other automatic control systems are functioning normally. It must also be ensured that the adjuster rods are within the regulation zone and that the neutron flux axial differential is within the permissible range. Otherwise, the boron concentration must be regulated or there must be a temporary stop in the increase of power or even a reduction of power.

When the output reaches 25 percent, 50 percent, and 75 percent of the rated value, determinations of the nuclear power and hot power must be made.

II. Some Limits in Start-Up

A. The temperature differential between the pressure stabilizer and the hot end of the loop must be within a 40 to 90°C range

This temperature differential is actually the degree of cooling of the reactor outlet water. Its lower limit is the safety margin required to prevent the occurrence of volume boiling at the top of the reactor core during the operating transient process. Volume boiling at the top of the reactor core indicates the possibility of bias bubble nuclear boiling on the surface of the element cladding that can result in burnup of the cladding. The upper limit is the thermal stress limit that the fluctuation pipes connecting the pressure stabilizer to the loop hot end can withstand during the operation transient state. It is quite obvious that the greater the temperature differential, the greater the thermal stress on the fluctuation pipes if there are fluctuations in the liquid level in the pressure stabilizer. Thus, it must be maintained within this temperature range throughout the entire start-up process.

B. The temperature differential for banning of the spray valve is 144°C

When the differential between the temperature inside the pressure stabilizer and the temperature of the spray liquid (i.e, the loop cold end temperature differential) $\Delta \geq 144$°C, the spray valve must be in a closed state. As mentioned previously, during the normal start-up and operation process, the temperature differential will not be that great. Sometimes, however, to avoid pressure transients in the main system that can damage the pumps during operation, an electrical heating component in the pressure stabilizer must be used to establish a steam cavity as quickly as possible (prior to pump start-up, for example). In this way, the effects of pressure transients in the main system basically can be ignored.

The stipulation of the 144°C limit was made in consideration of the technical requirements for PWR nuclear power plants built by the Westinghouse Electric Company in the United States. The stipulations for these nuclear power plants allow for the establishment of the pressure stabilizer steam cavity prior to the addition of diamine and deoxidation. At that time, the temperature of the primary system water is 80 to 90°C and the

temperature of the pressure stabilizer is about 230°C, so the temperature differential is between 140 and 150°C.

This limit is mainly to prevent the spray from significantly reducing the temperature of the water in the pressure stabilizer. The reason is that a significant reduction in the water temperature can cause problems in controlling the liquid level and pressure in the pressure stabilizer. Second, with a suitable temperature differential, the benefits of the spray head can be fostered normally. Otherwise, when the temperature differential is too great, the temperature of the spray liquid will be too low, which can cause changes in viscosity and so on, and cause changes in the diameter of the water droplets in the vapor coming out of the spray head, which can weaken the action of the condensed steam.

Moreover, if the volume of the water cavity in the pressure stabilizer is sufficiently large and the spray head is of a suitable design, the temperature differential limit mentioned above can be increased. At Japan's Tsuruga Nuclear Power Plant, for example, the stipulated temperature differential can be 176°C[1]. This limit is equivalent to the operating conditions prior to primary pump start-up when the pressure stabilizer has already established a steam cavity. Taking heat stresses on the spray pipes into consideration, however, this temperature differential should be no greater.

C. At the time of primary pump start-up, the main system pressure should be no lower than 2.74 MPa

This limit takes the following factors into consideration:

1. During primary pump start-up and operation, the pressure differential between the axial seals must be greater than 1.37 MPa and a water film must be formed between the surfaces of each of the seals to prevent the surfaces of the seals from sticking together. To meet this requirement, the minimum pressure of the injection water for the axial seals must be greater than 2.74 MPa.

2. To prevent steam corrosion on the primary pumps, their net positive suction pressure head p_n must be above 0.39 MPa.

Before the pressure stabilizer steam cavity is established, the maximum temperature of the primary coolant is about 180°C and the corresponding saturation pressure p_s is 0.98 MPa. Based on the relational expression

$$p \geq p_s + p_n$$

the minimum primary pump start-up pressure p is 1.37 MPa.

3. Consideration for prevention of cold brittleness destruction of the pressure vessel.

Based on 1. and 2., it is best for the main system pressure to be high during primary pump start-up and operation. This takes into consideration the fact that when the primary pumps have just been started up, the primary coolant water temperature is below 60°C. As the neutron radiation integral flux increases, and especially at the end of its lifetime, the brittleness migration temperature of the pressure vessel will rise substantially. Starting with the concept of preventing cold brittleness destruction of the pressure vessel, it is best if the start-up pressure of the primary pumps is not set too high. In summary, the 2.74 MPa limit satisfies all of the mutually antagonistic requirements. Moreover, stipulation of this limit basically holds the pressure of the main system at 2.74 MPa prior to the time that the temperature is raised to establish the steam cavity in the pressure stabilizer, so operation and control are easy.

D. The pressure differential between the primary and secondary sides of the steam generator should not exceed 11.03 MPa

This limit is only appropriate for start-up and operating conditions. Water pressure experiments, and so on are not subject to this limit. This limit actually requires that during the start-up process, as the main system temperature and pressure are being increased, the temperature and pressure of the secondary side of the steam generator are also increased at an appropriate rate.

Because the secondary side of the steam generator is basically in a saturated water-steam mixture state, this limit is actually a temperature differential limit to prevent the occurrence of heat stress damage due to the temperature differential in the pipe walls of the U-shaped heat transfer pipes being too great. At this pressure limit, the temperature differential between the primary and secondary sides can be as high as 150°C. In addition, such a large temperature differential is very bad for main system start-up and operation and it makes it easy for cooling water accidents to occur[2]. Moreover, if the pressure differential of the primary and secondary sides exceeds this limit during normal operation, main steam pipe rupture accidents can occur. In fact, the overall set limit for the pressure of the safety injection for ruptures of the main steam pipes is the difference between the normal operating pressure of the main system and this limit, which is 4.17 MPa.

E. The limit for the rate for the first power increase after reloading

According to the regulations, after the power is increased for the first time after reloading until it reaches 20 percent of the rated power, the power must be increased continually at a rate of less than 3 percent/hour until it reaches the rated power.

This is done to reduce the interaction of the fuel cores with the cladding (PCI). This type of interaction basically occurs after the core blocks come into actual contact with the cladding and it is extremely easy for them to cause the cladding to rupture.

During power operation, there is a very large radial temperature gradient within the core blocks that can cause cracking after a certain period of time and form several fan-shaped small blocks. Moreover, the thermal

expansion coefficient of the cladding material Zr-4 is only one-half that of the UO_2 core blocks[3], so under certain conditions the core blocks can come into contact with the inner surface of the cladding and create mechanical and chemical interactions after being in contact that can destroy the cladding. Three factors determine the effects of the core block and cladding interaction. They are fuel consumption, element rod linear power density, and the rate of local power increases. Moreover, the effects of the rate of local power increases mainly occur during the process of increasing the fuel power for the first time.

Experimental research has shown that if the rate of increasing the power for the first time is too great, the actual contact between the core blocks and the cladding may occur prior to the expected time, that is, prior to the second operating cycle (usually 2 years). This of course can increase the probability of element cladding destruction during operation. Thus, within the currently designed linear power density limits, to attain fuel consumption in excess of 3 X 10^5MW without causing destruction of the element rods from exceeding the design limit, the rate of the first power increase after loading or reloading must be controlled.

It should be explained that the limit for this rate is still appropriate for conditions when the time of operation at less than 20 percent of rated power is no greater than 30 days.

III. Discussion

A. Before starting to increase the temperature, the safety rods should be raised to the top

When placing the pressure stabilizer electrical heating component into operation and starting up the primary pumps, that is, prior to beginning to raise the system temperature, the safety rods should be raised to the top as part of the start-up sequence. Placing the safety rods at the top provides an excellent way to deal with elastic rod accidents or coolant water reactivity accidents that occur during the temperature raising process. Their sufficiently great negative reactivity properties provide considerable additional leeway for reactor system safety. Nearly all the PWR nuclear power plants in the world observe this operational procedure.

The design for Qinshan Nuclear Power Plant shows that there is an interlocking condition for all the control rods, including the safety rods. Both primary pumps must be in an operational state for the flow rate in the secondary loop to reach the stipulated value. This non-conventional arrangement cannot be accepted from the safety perspective, so the design must be revised.

Second, merely by adding a temperature unlocking condition to the safety rod low flow rate interlocking condition, the primary pumps are not started up at times of low temperatures and the safety rods can also be raised, and this does not affect the lowering of all the control rods to the bottom after the primary pumps stop operating after the temperature is raised. The set value for this temperature must only be slightly higher than the primary system temperature when the primary pumps should be operating.

B. Multiplier counting curves should be provided

When completing the boron release operation and lifting the adjuster rods to reach criticality, a multiplier curve (Figure 1, not reproduced) is extremely important for reactor operating personnel. Although its function is identical to that of the inverse counting curve and it provides a relatively accurate forecast of the actual critical rod position, it is much easier to use than the latter. It is used as follows:

A doubled counting rate for the rod position height is labelled on the vertical axis of the graph and after passing this point a straight line parallel to the horizontal axis is marked. The horizontal coordinate of the point where this straight line intersects the curve in the graph is the critical rod position. The multiplier counting curve has been adopted at many power plants. It is easy to use and provides ideal results. Physical design and experiment personnel should make the required efforts to provide a multiplier counting curve suitable for operating personnel at Qinshan Nuclear Power Plant as soon as possible.

C. The upper limit for raising the adjuster rods can be eliminated

Qinshan Nuclear Power Plant is a base load power plant and will not participate in system frequency regulation. For this reason, the adjuster rods should be raised to the top if at all possible during stable operation. This will help spread out the reactor core flux distribution.

Nuclear power plants that operate in a manner similar to this base load arrangement like Yugoslavia's Krsko Nuclear Power Plant have eliminated this quantity[4]. There is only a lower limit stipulated for the regulation zone of the adjuster rods and the upper limit is at the top. Their operating experience has shown that this operating arrangement has never caused problems due to a low differentiation value after the adjuster rods have been raised to the top, and safety problems are even more unlikely.

D. The operation time for nuclear heating

The technical regulations for Qinshan Nuclear Power Plant stipulate that operations to reach criticality can be carried out only after reaching 280°C, that is, after the reactor coolant reaches a hot state. Many other foreign countries also have this stipulation for their nuclear power plants. This stipulation is based on safety concerns and is extremely beneficial. It can ensure that the moderator temperature coefficient is a negative value throughout its entire lifespan, and it can ensure that the moderator temperature coefficient conforms to requirements at the end of its lifespan. Of course, the disadvantages of this stipulation are readily apparent. When hot

state operation is reached, relying simply on the operation of the primary pumps and the electrical heating components in the pressure stabilizer wastes a great deal of time. Lifting the rods during this interval and using nuclear heating can reduce the amount of time.

Based on actual conditions at Qinshan Nuclear Power Plant, the time of nuclear heating can also be moved ahead. This is because there is only a single signal for automatic unlocking of the safety injection at Qinshan Nuclear Power Plant, the P-11 (the set pressure value is 12.74 MPa), and there is no P-12 (the set temperature value is the hot state temperature, 280°C). This means that if the pressure exceeds 12.74 MPa, the safety injection system will be in an entirely hot reserve state, which will provide the necessary safety guarantees for the entire nuclear power plant. Thus, if physical personnel provide suitable information on the moderator temperature coefficient and the operating personnel have a prerequisite of obtaining sufficient operating experience, it is entirely possible to raise the control rods and reach criticality at 200 to 240°C and then carry out nuclear heating to speed up the rate of nuclear power plant start-up.

E. The question of low pressure safeguards

According to the regulations for Qinshan Nuclear Power Plant, after the steam cavity is established in the pressure stabilizer, the selector switches for the operating conditions of the pressure stabilizer pressure release valve can be changed from "low pressure" to "normal". The value set for opening the valve at "low pressure" is 4.41 MPa. This "low pressure" safeguard device protects the pressure vessel from damage by cold brittleness. According to experimental research and actual operating experience in many countries, when the temperature is 100°C, there are no problems of cold brittleness in the low-carbon alloy steel (similar to A-508 III and other pressure vessel steel materials). Moreover, between the time that the temperature in the primary coolant reaches 100°C and the steam cavity is established in the pressure stabilizer, it is entirely possible for pressure transients to occur and open the pressure release valve. In this state, water, not steam, passes through the pressure release valve. Hydraulic scouring by the rapidly flowing water obviously can affect the normal functioning of this valve and it may cause the safety film in the pressure release tank to explode, which could create definite problems.

For this reason, the time when the operating condition selector switch for the pressure release valve is changed from "low pressure" to "normal" should be moved ahead. This can be done when the primary system temperature reaches 100°C. Japan's Tsuruga Nuclear Plant stipulates that this switch can be made when the primary system reaches 130°C[1].

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Safety Shell of Qinshen Completed

926B0026A Beijing RENMIN RIBAO in Chinese 18 Oct 91 p 1

[Article by correspondent Jiang Hanzhen [5592 3211 4631] from Beijing on 17 Oct 91: "Safety Shell of Qinshen Completed"]

[Text] The safety shell of Qinshen has been successfully completed. It passed technical assessment in terms of design, construction, structural integrity and hemeticity.

Qinshen is the first pressurized water nuclear reactor independently designed and built by China. The safety shell is the structure to protect the main reactor building. It is a pre-stressed concrete structure in the form of a vertical cylinder. Its inner diameter is 36 m, wall thickness is 1 m, and internal ceiling is 64.1 m. The inside wall contains a 6-8 mm thick steel plate lining for sealing. The safety shell is the primary means to prevent the escape of radioactive materials which is extremely important in terms of environmental protection and resident safety. Over 1000 pre-stressed steel beams were distributed inside reinforced concrete channels across the safety shell of Qinshen to withstand any pressure as the result of an incident. Through model experiment and non-linear limiting state analysis, it was found to have a safety margin of a factor of 3.

The safety shell must withstand a variety of loads. In addition to withstanding pressure, it must be able to survive earthquakes, tornados and airplane crashes and remain undamaged. In particular, there are very rigorous requirements in hemeticity and structural integrity. From design study and experiment, safety analysis, construction, limiting load reevaluation, to final appraisal of the overall performance, the technical staff successfully conquered a series of hurdles in the construction of the safety shell of Qinshen.

This project was designed by the Shanghai Institute of Nuclear Engineering. Experts believed that the successful completion of the safety shell not only filled a void in China but also demonstrated our world class technical level.

Energy Ministry Proposes New Conservation Measures

926B0024A Beijing ZHONGGUO HUANJING BAO [CHINA ENVIRONMENTAL NEWS] in Chinese 12 Oct 91 p 1

[Text] Although China's energy resources industry during the last 10 years has had its achievements in energy conservation, in matters of technology and facilities control, it falls well behind when compared with advanced countries. Energy consumption per unit product is quite high, and for this reason the Ministry of Energy Resources is now promoting new concrete measures.

These measures are: renew and renovate the old high energy consuming facilities in the energy resource industries; in the electric power industry, the 2.000 to 10,000 kW medium and low voltage units, except those that have been changed for heating use, will be gradually replaced by large units before the year 2000; in the coal and petroleum industries, old blowers and water pumping facilities that are now in use will more quickly be replaced. Hereafter, new constructed thermoelectric units that use coal to produce power will not be allowed to exceed 330 kg per kWh, heat generating units will not be allowed to exceed 270 to 280 kg per kWh, and units that do not meet this requirement will not be approved for construction. New coal mines and oil wells must have advanced energy consumption indicators as a standard, and those that cannot meet that standard will not be built.

The Ministry of Energy Resources also declared that serious efforts must be made to raise the administration of fixed quota's as a central feature of energy conservation control, to consolidate the use of energy resources, to plug up runs, emissions, drips and leaks, and to constantly lower energy consumption. Mass media must be organized to create an atmosphere for every sort of energy conservation, to effect energy saving measures, and to save electricity in factories, enterprises, cities, villages, and homes.

Gansu Ponders Energy Conservation

916b0024B Lanzhou GANSU RIBAO in Chinese 16 Oct 91 P 1

[Article by reporter Zhang Yuxing [4545 3768 5281]]

[Excerpt] In today's world the energy crisis becomes more and more evident. In the 1970's, after China's supply of energy resources faced two "crises", the situation was much improved, but prospects for the future are not good. In 1989, Gansu's energy output reached a total volume of 16,547,200 metric tons of standard coal, but it is estimated that for more than 10 years after that, Gansu's energy output will be reduced to between 9 to 15 million standard-coal tons. The province's average per capita energy resources will be only 52.3 percent of the average for the whole country.

This is, in part, caused by a shortage of energy resources, but it is also caused by wasting of energy resources. In 1988, Gansu's energy and electric power consumption per 10,000 yuan of industrial output value were, respectively 75 percent and 178 percent above the national average and 5 times higher than Shanghai. Of the five northwest provinces, only Qinghai and Ningxia are higher. According to official findings, a considerable proportion of industrial facilities in Gansu are 1950-60 vintage, functionally antiquated, inefficient, and voracious consumers of energy.

The dire energy shortage and gradually diminishing margins for development, and the falling utilization levels are warnings that raising the energy saving consciousness of all the people, conservation of energy resources, and rational utilization of energy resources are extremely vital means to solve the energy problem.

From 1981 to 1989, the amount of energy conserved in Gansu was 5 to 6 million tons of standard coal, about 4 to 6 percent of the prime energy output during this period, and it was very helpful in staving off Gansu's energy crunch and helped to make up for the deficiencies. Saving energy and reducing consumption have a direct affect on economic development, and is definitely one of the most important measures needed to turn around Gansu's economic profit shortfalls. Heavy industry is a major high energy consumer in Gansu. The cost of energy resource raw materials averages more than 70 percent of product output costs in Gansu, the rate of energy consumption is the decisive factor in Gansu industrial economic profits. If Gansu's industrial output value per kWh of electricity was at the national average level, the annual industrial output value could increase by over 18 billion yuan, about double the present industrial output value. If Gansu's enterprises' energy resources and raw materials consumption indicators were to fall by 1 percent each year the earnings could increase by 100 million yuan per year.

The resource issue, from its very origin is closely bound to environmental issues. Energy conservation means improving the living environment for human beings. Increases in energy saving and reduction of consumption are directly related to increases in supply of energy resources (mainly coal, oil, and electricity). Reductions in the loss of ground cover in agricultural villages reduces soil erosion and intrusion of sand in the soil. Comprehensive development and recycling of energy resources can reduce urban atmospheric pollution and pollution from wastes. In 1990, the Provincial Electric Power Bureau's heat and power plants burned 3.98 million metric tons of coal, and produced 871,000 tons of ash. The ash [dump] covered 4,943 mu of land, seriously polluting the environment, but the renovated Lanzhou electric power plant made use of waste materials by retrieving the residual thermal energy in coal ash. It invested 100,000 yuan to build a coal ash production line, and in 1990 used 1,000 tons of powdered coal ash from its own industrial boilers to produce briquettes of high heat value at low cost. It is a thriving production and marketing effort with an output value of

270,000 yuan, and contributes greatly to the resolution of atmospheric pollution by coal smoke in winter in the Lanzhou area.

Saving energy and reducing consumption can fend off the looming crisis, raise economic profits to a considerable extent, and improve the ecological environment, but the many advantages of saving energy and reducing consumption have not yet been well impressed on all of the people. The energy industry clearly favors development over conservation. Each year, the 200,000 yuan allocated in Gansu for construction funds for electric power goes almost totally into development, but the new increases in energy for the most part are eaten up by the low efficiency facilities and high consumption processes. In actuality, in any given energy resource, the investment in conservation is only one-third that for development, but it gets faster results. Enterprises are required by government regulations to put 20 percent of their technology reform funds into energy conservation, but according to official findings, Gansu averages only about 15 percent. Many enterprises do not have special energy conservation technology reform funds, and some depend entirely on loans. Enterprises must be forceful and positive about saving energy and reducing consumption. In the external environment, the cost of energy resources is cheap, far below the value. There is no pressure on enterprises to save energy, the government laws and regulations for administration of energy resources are not strong, there is no supervision and examination, and there is no organization to enforce them. [passage omitted]

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